KNOWLEDGE TRANSFER
EMERGING ZONE

UNIVERSITY OF SZEGED

INTERDISCIPLINARY RESEARCH ACTIVITIES AT THE UNIVERSITY OF SZEGED

1 RESEARCH TEAMS

SZTE UNIVERSITY OF SZEGED

TARTALOM

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www.med.u-szeged.hu

UNIVERSITY OF SZEGED

FACULTY OF MEDICINE

Research is vital to our mission at the Medical Faculty of University of Szeged. The medical school has a long tradition of translating laboratory discoveries to bedside application, ultimately improving the health. Our faculty have active research programs covering virtually every aspect of basic, clinical and public health science, and they educate the next generation of scientists through our graduate training programs. In addition, our investigators are advancing medicine through collaboration with departments and schools across Hungary including life sciences.

MOTTO:

NEW DISCOVERIES SAVE LIFES

DEPARTMENT OF PHARMACOLOGY &PHARMACOTHERAPY

The Department of Pharmacology & Pharmacotherapy, Faculty of Medicine, University of Szeged, has been dealing with cardiovascular, especially with antiarrhythmic research under the leadership of Professors László Szekeres, Gyula Papp and András Varró .

1. HAEMODYNAMICS RESEARCH TEAM

The investigation of the protective role of the endogenous agents in the various pathological status of the heart.

2. IN VIVO SMALL ANIMAL ARRHYTHMIA RESEARCH TEAM

The investigation of electrophysiology of the sudden cardiac death.

3. IN VITRO VASCULAR AND SMOOTH MUSCLE RESEARCH TEAM

The investigation of the endothelium dependent vasoconstriction in smooth muscle.

4–7. IN VITRO ÉS IN VIVO CELLULAR ELECTROPHYSIOLOGICAL RESEARCH TEAM

IN VIVO ARRHYTHMIA AND ELECTROPHYSIOLOGICAL RESEARCH TEAM AND OPTICAL METHODS & MOLECULAR BIOLOGICAL RESEARCH TEAM AND MTA-SZTE RESEARCH GROUP OF CARDIOVASCULAR PHARMACOLOGY)

The investigation of the role of repolarization in the sudden cardiac death (SCD): SCD in top athletes, heart failure and atrial fibrillation. The design and preclinical investigation of new antiarrhythmic agents.

1ST DEPARTMENT OF INTERNAL MEDICINE

COLORECTAL WORKGROUP

Our workgroup is one of the most active and effective research teams at the First Department of Medicine, University of Szeged. Our research work is primarily intents to (1) the diagnostic and therapeutic possibilities of Inflammatory Bowel Diseases (IBD) (Crohn's disease (CD) and ulcera-

tive colitis (UC)), (2) the investigation and palliative care of the gastrointestinal malignancies, (3) and the diagnostic and operative endoscopic techniques (particularly endoscopic ultrasound).

Leader: **Tamás MOLNÁR MD, PhD**, *habil., professor, physician, gastroenterologist*

ACTIVITY OF THE DIABETES TEAM

- Cardio-diabetology: clinical study of disturbances of cardiovascular adaptation mechanisms in diabetic patients.
- Gastrodiabetology: characterization of esophageal, gastric and gallbladder motility parallel with cardiovascular autonomic tests, assessment of digestive symptoms and the associated peripheral sensory and central afferent dysfunctions.
- The effect of diabetes duration, the glycemic control and glucose variability on different neuronal functions is analysed in both groups.
- Clinicopharmacology: conduction of phase I-IV studies

ENDOSCOPIC GROUP

Group leader: **Prof. Dr. László CZAKÓ**

FIELDS OF RESEARCH:

- Diagnostic endoscopic ultrasonography
- Performing clinical and clinico-pharmacological studies and providing expert opinion/consultation in the abovementioned projects
- Endoscopic training

HEPATOLOGY WORKGROUP

Head: **Istvan NAGY MD**
head clinician, internist, gastroenterologist

CLINICAL RESEARCH - MAIN AREAS:

- therapy of chronic hepatitises (new drugs, decreasing iron level, and so on)
- pathogenesis and therapy of alcoholic liver disease
- the role of cytokines in liver disease
- the role of Helicobacter sp. in the pathogenesis of primary biliary cirrhosis and other liver diseases
- new haemostatic procedures in endoscopy

NEPHROLOGY-HYPERTENSION CENTER WORKING GROUP ON NEPHROLOGY AND HYPERTENSION

1st Department of Internal Medicine, Nephrology-Hypertension Center, Excellence Center of the European Society of Hypertension

Head of the Center: **Prof. György ÁBRAHÁM MD**
PhD, professor of internal medicine, internist, nephrologist, diabetologist, hypertonologist, Hypertension Specialist of the European Society of Hypertension (ESH)

The Working Group performs mainly clinical investigations on hypertension, measuring the short-term cardiovascular regulation and arterial stiffness with different methods. On nephrology they investigate the clinical consequences of different glomerulonephritises diagnosed by kidney biopsies.

2ND DEPARTMENT OF MEDICINE

CARDIOLOGY CENTRE

The role of long-term physical training-induced cardiac hypertrophy in sudden cardiac death events among athletes is investigated.

RESEARCH GROUP OF EXPERIMENTAL ARRHYTHMOLOGY AND CIRCULATION

Senior researcher and group leader: **András FARKAS** *MD, PhD*

Our group is interested in cardiovascular and arrhythmia research. Our investigations mainly focus on drug-induced arrhythmias. We routinely use the following two experimental models in our lab.

CLINICAL MICROBIOLOGY INSTITUTE

The Clinical Microbiology Institute of University of Szeged has been estabilished with a purpose to provide a wide-spectrum service for their patients at the clinics and ambulances. In the Institute internationally renowned research work is conducted on the field of Clinical Microbiology: trials and evaluations of novel diagnostic methods; special emphasis is put on the examinations of the roles of anaerobic pathogens in various human diseases, epidemiological following of their antibiotic resistance levels and mechanisms, and investigations in their virulence properties. An important and special pathogen is Clostriduim difficile, and we examine its toxinogenic properties, type them and follow its antibiotic resistances. We are also involved in the detection and examination of dangerous resistance mechanisms aerobic pathogens as extended-spectrum β-lactamase production (ESBL) and multidrug-resistance of pseudomonas.

CLINIC OF DERMATOLOGY AND ALLERGOLOGY, MTA-SZTE DERMATOLOGICAL RESEARCH GROUP

Our research group focuses on the better understanding of the mechanisms in chronic multifactorial inflammatory skin diseases like psoriasis and acne. Although in the last decade the clinical application of biological therapy was a major milestone in the treatment of psoriatic patents it has become clear that by blocking inflammatory mechanisms alone does not result in long term symptom free stage in patients. Therefore our research aims the elucidation of skin related mechanisms that would provide newel knowledge which could serve as a base for therapies leading to a long term symptom free stage for patients suffering from psoriasis.

DEPARTMENT OF PUBLIC HEALTH

Sociological, epidemiological surveys

The Department of Public Health at the University of Szeged, Faculty of Medicine studies the health status of the population. The Department conducts complex sociological and epidemiological surveys aiming to reveal the relationship between health status and social conditions and lifestyle. The analysis enables us to find out the health status and the determining lifestyle, behavioural and environmental factors, and the effects of different interventions, health promotion and prevention programs.

GROUP OF EXPERIMENTAL NEUROIMAGING

The Department of Medical Physics and Informatics of University of Szeged

The major goal of our research is to identify pathophysiological processes relevant to the evolution of ischemic brain injury.

DEPARTMENT OF MEDICAL GENETICS

The "Research and Diagnostic Laboratory of Rare Diseases" is supervised by Prof. Márta Széll at the Department of Medical Genetics, University of Szeged, Szeged, HUNGARY. The laboratory focuses on the genetic background of rare, monogenic diseases. The main purpose of our research work is to develop population-specific mutation panels, to prepare mutation database and to carry out functional investigations. The primary purpose of our diagnostic work is to identify the underlying causative mutations in patients with rare diseases supervised by the clinician colleagues. This latter activity not only fulfills diagnostic purposes, but may also have significant clinical consequences for example in the selection of the optimal treatment and also in family planning.

DEPARTMENT OF RHEUMATOLOGY

The Department of Rheumatology can contribute with the following services:

A large cohort of patients suffering from systemic autoimmune diseases and inflammatory rheumatic diseases covering the region of South-East Hungary. These cohorts contain patients treated and followed-up following the latest international guidelines, and their database is being regularly updated. Currently there are approximately 1000 patients with rheumatoid arthritis (including several research sub-groups, such as a) recent onset, therapy-naive patients, b) patients treated with biological therapy – both with good response and therapy-resistance, c) patients in whom the biological therapy has been stopped, d) patients in sustained remission. Three-hundred patients with SLE (indluding approximately 50 patients with biopsy-proven lupus nephritis), 150 with Sjögren's syndrome, 70 with scleroderma, and 30 each with myositis, antiphospholipid syndrome and ANCA-associated vasculitis. In our biobank, currently we collect biological samples from 6 prospective studies.

INSTITUTE OF SURGICAL RESEARCH

The investigation of microcirculatory changes is currently in the focus of in the physiology and pathophysiology and pharmacology research. Nowadays more and more emphasis is put on these examinations in the clinical diagnostics as well: The results, provided by the basic research facilitated the dynamic development of several imaging devices. Our research team has been involved in the examination of the microcirculation . Currently we apply four kind of invetigatory techniques for the more closer recognition of the microcirculatory disturbances and for the examination of possible ways to influence those alterations.

INSTITUTE OF SURGICAL RESEARCH RESEARCH GROUP FOR MITOCHONDRIAL PATHOPHYSIOLOGY

Mitochondria, which are key components in an array of processes in the cellular physiology, play a central role in the development of various acute and chronic diseases. Our research group deals with the mitochondrial manifestation of different diseases and the therapeutic effects of potentially protective agents on mitochondrial dysfunction. In the Laboratory for mitochondrial pathophysiology, we investigate samples collected from animal studies such as ischemia-reperfusion, inflammatory bowel diseases and systemic inflammation. Furthermore, we conduct in vitro studies and the lab has the ability to assess samples harvested from human patients.

OBSTETRIC AND GYNECOLOGICAL CLINIC

The Obstetrical Ultrasound Workgroup is to develop and apply in pregnancy care. The main research fields are: fetal renal vascularization, placental vascularization in pregnancies complicated with gestational diabetes mellitus, pregnancy hypertension, intrauterine growth restriction, and in twin pregnancies. The in-vivo funcional examination is applied in placenta and fetal kidneys.

DEPARTMENT OF PULMONOLOGY, RESPIRATORY PHYSIOLOGY RESEARCH GROUP

Principal Investigator: **Zoltán HANTOS PhD, DSc**, *professor emeritus*

The team conducts research in areas of respiratory physiology and pulmonology, supported by experimental and clinical methods and measurement technologies. The main lines of research are as follows. Respiratory mechanics, structural-functional background of respiratory disorders. Development of novel methods of lung function. In the current focus of the applied research is a new approach to the forced oscillation technique that follows the within-breath changes of respiratory mechanical parameters.

DEPARTMENT OF PULMONOLOGY

We will study arterial stiffness changess in patients with COPD with Prof. Dr. Somfay Attilla management. For several decades take place rehabilitation and related research work in the Hospital of Thoracic Diseases in Deszk. The positive effects of exercise training has been known in this

research place. Our research group aims to examine the effectiveness of pulmonary rehabilitation with a relatively new, in Hungary developed, internationally accepted instruments, the arteriograph. Our observations focused on the comparison of interval and continous physical training impact on arterial stiffness.

TEM LABORATORY IN UNIVERSITY OF SZEGED DEPARMENT OF PATHOLOGY

- Our TEM laboratory support bronchial biopsy; muscle biopsy; neuro-muscle biopsy; kidney biopsy; heart muscle biopsy. In case of the bronchial biopsy this we are the central laboratory in Hungary.
- In our TEM laboratory there are used the latest technology in sample preparations and examinations of them.
- All steps of samples preparation are automated as it is possible, like embedding, and staining with heavy metals. For these reasons the quality of specimens are standard and with price/value ratio is satisfied highly. The used technology is guaranty for minimized quantity of hazardous waste.

PSYCHIATRIC CLINICAL INSTITUTE OF MEDICAL FACULTY

Innovative research areas in our Institute

The research laboratory of the Psychiatric Clinical Institute is involved in high quality work in the fields of neurodegenerative diseases and psychiatric disorders, in preclinical and clinical phase. Main research focus on finding biomarkers in neurodegenerative and psychiatric disorders detected from teardrops (lacrima), liquor, blood serum, human fibroblasts and transgenic stress model mouse strains in proteomic and transcriptional levels. The effects of acute depression on Alzheimer's disease related molecular proccesses in APP/PSEN transgenic and wild type mice. The impacts of APO B transgene on Alzheimer's disease associated molecular changes in stress triggered depression model in mice. Genetic analysis of the RELN gene, the SNP analysis of TREM and defensins and the proteomic measurement of their alterations in CSF and serum of patients with Alzheimer's disease and specific lipimic analysis of cerebrospinal fluid are also carried out.

DEPARTMENT OF UROLOGY

In addition to the general urological supplies your primary task urological surgical care for cancer patients which is often very stressful for the patient. Urological surgery requires the use of minimally invasive techniques. Laparoscopic procedures are now the keys to minimally invasive surgery. The laparoscopic technique makes it possible to perform several procedures through very small skin, incision against the large incisions of the traditional surgery. Inserted trocars through a small incision allow the insertion of various operating devices to the surgical area. CO_2 insufflation ensure adequate space for the operational area. Laparoscopic surgery is main advantages are that the pain is lower and faster the recovery time than we can experience in traditional surgery. The surgical area shows a the magnitied image, that allows precise intervention, reducing possible blood loss during surgery. After the laparoscopic surgery, the surgical scars hardly visible, the cosmetic result is excellent. Laparoscopic intervention has become standard intervention in number of diseases.

www.sci.u-szeged.hu

UNIVERSITY OF SZEGED

FACULTY OF SCIENCE & INFORMATICS

The educational and research activities at the Faculty of Science and Informatics of the University of Szeged are organized within the six institutes according to the scientific disciplines. These institutes function as partially independent teaching and research units. The expertise of the scientists covers the significant areas of sciences and informatics.

MOTTO:

DETECT AND COMPREHEND

INSTITUTE OF BIOLOGY

MICROBIOLOGICAL AND BIOTECHNOLOGICAL SERVICES

Contact person: **Dr. Ilona PFEIFFER**
E-mail: **pfeiffer@bio.u-szeged.hu**
Phone +36 **62 544 517**

Classical cultivation methods are used at our institute to detect microbial contents of different samples (i.e. wrappers, food stuffs and cosmetic products etc.) and to determine the colony forming units of the contaminant microorganisms. Methods based on similar principle are applied to check the infection points which may occur during the food industrial and pharmaceutical manufacturing processes. We also offer the deposition of different isolates of microorganisms in our internationally recognized culture collection and the breeding, creating and selection of microbiological strains.

BIOLOGICAL EFFECT ASSAYS

Contact person: **Dr. Anikó PÓSA**
E-mail: **paniko@bio.u-szeged.hu**
Phone +36 **62 543 881**

The toxicology tests are conducted in the GLP certified unit (OGYI40300-5/2013) of our Institute on animals and investigate the relationship between the dose level, frequency of dosing, duration of exposure of organisms and the short or long term survival to measure acute, subchronic and chronic toxicity of compounds.

Furthermore, our Institute could test the toxicological effects of different chemical components or products with in vitro human cell assays, and the possible antibacterial and antifungal effects showed against microorganisms. The biological effect assays could also involve the mutagenic and genotoxicity tests in the frequently applied multicellular model organism (Drosophila melanogaster).

BIOACTIVE MATERIALS: PRODUCTION, PURIFICATION AND BIOTECHNOLOGICAL APPLICATIONS

Contact person: **Dr. Gabor RÁKHELY**
E-mail: **rakhely.gabor@bio.u-szeged.hu**
Phone +36 **62 544 622**

Applying well-controlled fermentation technology, whole cell catalysts, enzymes, peptides and other bioactive materials can be produced. The Institute provides fermentors with different capacities to produce microbial secondary metabolites in large scale and to prepare large amount of living cells. The products can be applied directly or can be further purified by various separation techniques. Our Institute could undertake the isolation and preparative purification of organic chemical components from samples coming from external clients. Furthermore, we possess remarkable professional background and instrumental capacity for the purification and characterisation of proteins and enzymes.

PLANT PHYSIOLOGY MEASUREMENTS

Contact person: **Dr. Péter POÓR**
E-mail: **poorpeti@bio.u-szeged.hu**
Phone +36 **62 544 307**

We are able to measure plant photosynthetic activity from single cell, tissue and organ to individual plant species and to complete these results with other important physiological, biochemical and molecular biological investigations. Our methods are useful to determine the effects of pesticides, environmental contamination or other stresses on photosynthetic apparatus and CO_2 assimilation or other signaling components which play an important role in plant development, productivity and stress resistance.

INSTITUTE OF PHYSICS

MEASUREMENTS WITH ULTRAVIOLET-VISIBLE, FEMTOSECOND PULSES

Contact: **Prof. Dr. Sándor SZATMÁRI**
E-mail: **Szatmari.S@physx.u-szeged.hu**
Phone +36 **62 544 357**

The High Intensity Laser Laboratory, Department of Experimental Physics, provides capabilities to carry out experiments and measurements in the fields of material research, plasma physics, biophysics, medicine, photonics etc. with femtosecond pulse duration at 248 nm, 497 nm, and nanosecond pulse duration at 193 nm, 248 nm, 308 nm wavelengths.

Main fields:

- Harmonic generation on solidstates and in gases.
- Plasmaphysical applications.
- Time-resolved spectroscopy: pump-probe measurements in ns, ps and fs scales at different wavelengths and pulse energies.
- Materials science, surface machining and surface structuring.
- Nonlinear optical measurements.

AMPLIFIED ULTRASHORT LASER PULSES FOR ELI-ALPS-RELATED SCIENTIFIC APPLICATIONS

Contact: **Dr. Ádám BÖRZSÖNYI**
E-mail: **badam@titan.physx.u-szeged.hu**
Phone +36 **62 343 747**

The TeWaTi research group's main activities are related to research and development of generation and investigation of high intensity, ultrashort laser pulses. Our laser laboratory provides resources and location for several national and international research collaborations; in this way, sup-

ports Hungarian scientists to get easier access to the ELI-ALPS facility. The unique variety of light sources and detectors allows users to perform experiments with spectrally tunable (from the UV to the MIR), intense fs and ps pulses for scientific, industrial or medical applications. We can offer services for numerous scientific fields including – but limited to – time resolved spectroscopy, plasma physics, nonlinear optics, material processing, surface structuring, high harmonics and attosecond pulse generation, characterization of photonic crystal fibers and development of laser diagnostic methods.

LASER PHOTOACOUSTIC SPECTROSCOPIC MEASUREMENTS

Contact: **Prof. Dr. Zoltán BOZÓKI**
E-mail: **zbozoki@physx.u-szeged.hu**
Phone +36 **62 544 406**

The laser photoacoustic spectroscopy based measurement systems developed by our research group are suitable for the analysis of various gas mixtures as well as optical characterization of aerosols. These systems provide high sensitivity, selectivity and short response time under uniquely wide dynamic range. Our present systems are optimized for the analysis of aerosols, humidity, natural gas or exhaled air composition, permeability of membranes and rocks. Our versatile core technology enables the development of tailored systems for environmental, industrial and clinical applications.

INSTITUTE OF GEOGRAPHY & GEOLOGY

CLIMATE CONSCIOUS CITY AND GREEN SPACE PLANNING

Contact person: **Márton KISS**
E-mail: **kiss.marton@geo.u-szeged.hu**
Phone +36 **62 543 172**

We undertake integrated evaluations of thermal comfort characteristics of buildings and public open spaces by carrying out field surveys with our two mobile urban climatological measurement stations.From the detailed tree datasets, we calculate some important ecosystem services of the investigated stands (carbon sequestration, air pollution removal). We provide services connected to forest structure analysis, delineation and classification of forest types based on remotely sensed and aerial imagery, in cities and in other landscapes. We also undertake the integration of these types of data in complex GIS databases and their monitoring.

GEOMATHEMATICAL ANALYSES

Contact person: **Dr. János GEIGER**
E-mail: **matska@geo.u-szeged.hu**
Phone +36 **62 544 893**

Traditionally the term of geomathematics is a collective noun of all the statistical and geostatictical tools applied in geosciences. We can provide Data Quality Assessment (DQA) for the evaluation of environmental monitoring systems in which the main emphasize is placed on the analysis of decision errors. Multivariate statistical techniques like cluster, factor, principal component analysis or neural network solutions help to identify rock bodies of safe and contaminated regions. Geostatistics is a flagship of our activity in the characterization of hydrocarbon reservoirs. In this field, we apply wide range of stochastic simulations offered by WINGSLIB and SGeMS in the description of reservoir uncertainty.

GEOINFORMATICS ANALYSIS

Contact person: **Dr. László MUCSI**
E-mail: **mucsi@geo.u-szeged.hu**
Phone +36 **62 544 397**

Geoinformatics is important for us as an independent discipline in which data acquisition, data management and data processing can be evaluated and developed. On the other hand it is also an important method applied in different geographical researches, as it is used for spatial and temporal analyses, visualisations and interdisciplinary evaluations. On the basis of our research activities, two major fields can be separated. The remote sensing includes satellite image analysis, photogrammetric data acquisition and analysis. Within the scope of applied GIS (Geographical Information System) the main tasks are field data acquisition, solving environmental problems, identifying landscape patterns and processes, spatial and temporal data analysis.

INSTITUTE OF INFORMATICS

AUTOMATED ANALYSIS OF IMAGE DATASETS

Contact: **Dr. László NYÚL**
E-mail: **nyul@inf.u-szeged.hu**
Phone: -+36 **62 546 196**

Processing large sets of 2-dimensional images, 3-dimensional volumetric data, image series and video sequences can be sped up with automated methods. Our professional researchers can manage automated analysis of various types of image datasets, such as images produced by medical imaging devices (e.g., Röntgen, CT, MRI, PET, SPECT, OCT), light or electron microscopy, aerial photographs, point clouds measured by range camera or Lidar scanner, digital photographs, or video streams from surveillance cameras.

SOLUTIONS FOR SPECIAL INDUSTRIAL AND MEASUREMENT TECHNOLOGY PROBLEMS

Contact: **Dr. Róbert MINGESZ**
E-mail: **mingesz@inf.u-szeged.hu**
Phone: +36 **62 544 068**

We have expertise in the following areas: development of specialized embedded (hardware and software) systems and prototypes, development and implementation of specialized measurement systems, consulting on the topic of measurement technology, development, and implementation of automated machines, and systems in industrial areas.

SOFTWARE QUALITY CONTROL

Contact: **Dr. Rudolf FERENC**
E-mail: **ferenc@inf.u-szeged.hu**
Phone: +36 **62 544 145**

Our experts in source code analysis, and software-code base quality assessment can reveal all the facts about your Java, C/C++, C#, Python JavaScript, RPG, or SQL source codes. The reports contain software metrics, code duplications, coding problems and suggestions for the improvement of the code.

Our ISTQB certified software testing professionals manage manual, regression, handover-takeover ting and test automation, test optimization.

SOFTWARE DEVELOPMENT

Contact: **Dr. Vilmos BILICKI**
E-mail: **bilickiv@inf.u-szeged.hu**
Phone +36 **62 546 781**

Professionals in the Department of Software Engineering join software engineering and development with many years of expertise in the following areas:

- Development of Open Source solutions in environments,
- Development of mobile applications for native and crossplatform systems. Creation of M2M cloud-based systems,
- Application development for desktop and server environments under Windows, Android, iOS/OS X, or Linux platforms,
- Implementation of Telemedicine applications, solutions, and projects,
- Development, and performance analysis of cloud-based services.

TECHNOLOGICAL EDUCATION

Contact: **Dr. Róbert MINGESZ**
E-mail: **mingesz@inf.u-szeged.hu**
Phone +36 **62 544 068**

Our qualified colleagues provide advanced training in three topics of informatics.

- AutoCAD and technical design,
- CISCO CCNA, CCNP network management,
- Personalized control theory and measurement techniques education in the following topics: electronics, software-defined instruments, advanced control technology, microcontrollers, embedded systems, FPGA, and sensor networks.

INSTITUTE OF CHEMISTRY

SPECTROSCOPY/SPECTROMETRY SERVICES

Contact person: **Dr. Gábor GALBÁCS**
E-mail: **galbx@chem.u-szeged.hu**
Phone: +36 **62 544 013**

A broad range of measurement tasks can be solved with our sensitive and accurate spectrometers. The list of possible tasks includes, among others, the determination of the atomic or molecular chemical composition of liquid, bulk or powdered solid samples, gases, as well as the investigation of the composition or thickness of films (e.g. metallic or polymer coatings, paint layers). In the case of certain sample types, the assessment of the chemical structure is also possible. We also take part in projects aiming at the development of methods of sample preparation, instrumental analysis and data evaluation, as well as the construction of spectroscopic instrumentation useful for monitoring industrial processes.

CHARACTERIZATION OF MATERIALS IN SOLID, LIQUID AND GASEOUS PHASES

Contact person: **Dr. Henrik HASPEL**
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Phone +36 **62 544 622**

We are able to characterize the thermal stability and phase transformations of materials by thermal analysis techniques, i.e. thermogravimetric analysis and scanning calorimetry. Information on the temperature-dependent mechanical properties of polymers can be gained by dynamic mechanical analysis and tensile strength measurements. With X-ray diffractometry determination of the crystal structure and phase identification in solids is possible. Furthermore, we can measure the electrical conduction of solids and liquids with high precision, while molecular components can be identified by vibrational spectroscopy (FT-IR, Raman) techniques.

MICROSCOPY SERVICES

Contact person: **Dr. Ákos KUKOVECZ**
E-mail: **kakos@chem.u-szeged.hu**
Phone +36 **62 544 620**

Structural investigation (composition, layers, morphology) of unknown solid materials by scanning electron microscopy (SEM). Quantitative determination of elemental composition, line scan and area scan elemental mapping as well as quality control of known materials (e.g. alloys, composites, porous systems) by SEM-EDS. Submicron resolution imaging of surface defects (e.g. coating failure, erosion and corrosion), combined with elemental analysis. High pressure (100 Pa) SEM for the characterization of vacuum unstable materials. Transmission electron microscopy for materials science applications (200 kV): quantitative characterization of the morphology, size distribution and crystal structure of nanoparticles. Atomic force microscopic investigations to reveal the submicrometer unevenness of flat surfaces. Analysis of organic and inorganic microparticles using IR and Raman microscopy. Identification of e.g. paint stains, textile fibers, polymeric contamination from trace amounts. Depth profiling using confocal Raman microscopy.

INSTITUTE OF ENVIRONMENTAL & TECHNOLOGICAL SCIENCES

ENVIRONMENTAL MONITORING AND REMEDIATION

Contact person: **Dr. Katalin PEREI**
E-mail: **perei@bio.u-szeged.hu**
Phone +36 **62 544 853**

Our group can detect the presence of oils, a number of various substituted organic compounds and toxic heavy metals in waste with GC, GC-MS, HPLC, ICP and classical analytical methods. Numerous microbial strains capable to convert/utilize these harmful compounds are available in our labs. Large amounts of cells can be generated by controlled fermentation for bioaugmentation and the biodegradation processes can be monitored by the analytical methods mentioned above. The biodegradation potential of a contaminated site might be established by modern high-throughput molecular methods. Proper bioremediation process can be developed owing to the multidisciplinary knowledge of our institute.

BIOFUELS

Contact person: **Dr. Gábor RÁKHELY**
E-mail: **rakhely.gabor@bio.u-szeged.hu**
Phone: +36 **62 546 940**

By depletion of fossil fuels renewable energy sources are becoming necessary. Gaseous biofuels such as biomethane, biohydrogen, biohythane are suitable energy carriers which can be produced from industrial, agricultural wastes and energy plants. Proper well-controlled fermentation technologies for optimization of biogas production from various feedstocks are available in our labs. The process can be followed by standard analytical techniques. Our goup can also monitor the temporal microbial composition of the fermentation. Based on these results, efficient biogas producing technology can be developed.

BIODIVERSITY MONITORING

Contact person: **Dr. Róbert GALLÉ**
E-mail: **galle.robert@gmail.com**
Phone +36 **62 546 952**

The competence of our research group includes species- and habitat-level biodiversity assessment and the monitoring of their changes over various time scales. We can ensure preparing the adequate sampling method for each monitoring project and can collect field data for several taxonomic groups, including vascular plants, arthropods (ants, true bugs, spiders, carabid beetles, orthopterans etc.) and vertebrates. We can also perform the statistical evaluation of the results and the assessment of their implications for conservation. Our monitoring projects can also provide grounds for environmental impact assessments.

THE BOLYAI INSTITUTE

STATISTICAL DATA ANALYSIS AND CONSULTATION

Contact person: **Dr. Gábor SZŰCS**
E-mail: **szucsg@math.u-szeged.hu**
Phone +36 **62 544 080**

Assistance in the design of statistical surveys, statistical data analysis, the identification of significant and random effects, determination of confidence intervals and construction of forecasts. Based on the achieved results we make recommendations to develop effective protocols in areas such as health care or quality control.

THE SOLUTION OF OPTIMIZATION PROBLEMS

Contact person: **Dr. Géza MAKAY**
E-mail: **makayg@math.u-szeged.hu**
Phone +36 **62 544 091**

Engineering optimization, architectural design optimization, logistics optimization, design of algorithms. Creation of Web databases for accounting, asset tracking, library management systems, and inventories. Editorial and publisher systems. The natural language, graphical and mathematical analysis of databases.

MATHEMATICAL MODELS OF COMPLEX SYSTEMS, SIMULATIONS

Contact person: **Dr. János KARSAI**
E-mail: **karsai.janos@math.u-szeged.hu**
Phone +36 **62 544 185**

Construction and study of models; simulations and parameter identification for applications in engineering, physics, medicine, pharmacy, ecology and environmental protection. In particular, forecast and impact assessment of epidemic processes, spreading and competing species; planning vaccination strategies.

www.pharm.u-szeged.hu/english

UNIVERSITY OF SZEGED

FACULTY OF PHARMACY

THE FACULTY OF PHARMACY IS A PART OF THE UNIVERSITY OF SZEGED, WHICH IS ENTITLED TO BEAR THE EXCELLENT AND HUNGARIAN RESEARCH UNIVERSITY TITLES. IN THE INSTITUTES OF THE FACULTY HIGH-QUALITY RESEARCH AND DEVELOPMENT WORK IS GOING ON. THE HIGHLY QUALIFIED TEACHING AND RESEARCH STAFF OF THE FACULTY CAN PRODUCE INTERNATIONALLY RECOGNIZED SCIENTIFIC RESULTS.

In addition to basic research, there is great emphasis on innovative drug research, so the Faculty maintains close and fruitful relationships with almost all participants of the national pharmaceutical industry, national and international universities and research institutions.

On the following pages we would like to introduce the most important instruments of the Faculty of Pharmacy to our partners. Our faculty awaits its partners' orders for carrying out research, development and innovation work or implementation of instrumental measurements.

MOTTO

UNITY OF EDUCATION, RESEARCH AND INNOVATION FOR THE FUTURE OF PHARMACY

DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

Pharmaceutical technology is one of the most dynamically developing fields of the pharmaceutical sciences. In our department the extensive research work is strongly connected with industrial developments and innovations. The 4 team offer high end analysis with advanced analytical technologies (DSC, TG-MS, FT-IR, NIR, hot-humidity XRPD) and imaging techniques (Raman-microscopy, SEM, μCT) and development of innovative compositions and up-to-date technologies not only for the pharmaceutical industry but also for the cosmetic, nutraceutical and food industries.

The 1st team has experience in the R&D of various single-unit or multiparticulate solid dosage forms. The focus of their research activity is the solid state characterization, process optimization and in silico modelling of the production of conventional and innovative solid dosage forms, and the formulation possibilities of nanomaterials and proteins or peptides into solid drug delivery systems (DDS).

The 2nd team develops liquid and semisolid dosage forms and drug carrier systems for dermal, transdermal, ocular and periodontal applications. Intensive research is performed on the formulation of modern drug delivery systems such as lyotropic liquid crystals, nanoemulsions, solid lipid nanoparticles and bioadhesive DDSs. The instruments enable the investigation the drug diffusion and penetration through different synthetic and biological membranes and characterisation the structural properties and rheological parameters of the formulations.

The 3rd team has special expertise in the R&D of formulations improving solubility by cyclodextrin inclusion complexation, solid solutions and solid dispersions with water soluble additives and amorphization for bioavailability improvement of water insoluble drugs which is a key issue of the recent pharmaceutical developments, and has also much experience in the field of crystallization, spray-drying and lyophilization.

Nanotechnology is in the main focus of the research work of the 4th team, including the application of different methods for particle size reduction and R&D of micro- and nanoparticle based DDSs for target therapy. Our special interest is also turned to drug delivery across artificial and biological barriers containing in vitro, ex vivo and in vivo permeability studies and investigation of micro- and nanoparticles for use through pulmonary and nasal administration routes to reach the blood circulation and to target the brain.

DEPARTMENT OF PHARMACOGNOSY

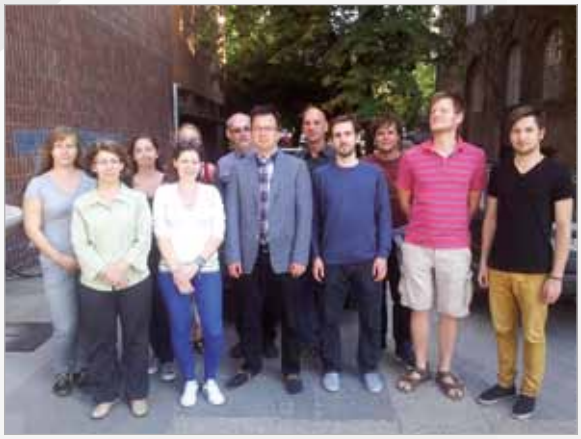
The research area of natural products research group is isolation and structure determination of biologically active compounds, especially terpenoids and phenolic compounds from plants (Euphorbiacea, Asteraceae, Polygonaceae and Juncaceae families) and mushrooms (e.g. Collybia and Tricholoma species). The isolation of compounds is performed with the combination of different chromatographic techniques (CPC, VLC, TLC, RPC and HPLC). The structures of the components are elucidated by means of spectroscopic methods (NMR and MS). Pharmacological investigations are performed in the Department of Pharmacognosy (xanthine oxidase and ACE inhibitory activities) and in cooperation (e.g. antitumour and multidrug resistance reversing activities). The head of the research group is Prof. Judit Hohmann, the members are: Dr. Zsuzsanna Hajdú, Dr. Erzsébet Háznagy-Radnai, Dr. Dóra Rédei, Dr. Attila Ványolós and Dr. Andrea Vasas.

Phytochemical quality and safety analysis of plant-based products. Quality and safety of herbal products are cornerstones of modern phytotherapy. Our research group focuses on the qualitative and quantitative analysis of active constituents, marker compounds and contaminants of herbal extracts and final products, using spectrometric and chromatographic methods as well as phytochemical analytical experiments related to toxicological and pharmacokinetic studies. The head of the research group is Dezső Csupor, the members are Tivadar Kiss, Attila Csorba, Nikoletta Jedlinszki and Katalin Veres.

The natural and bio-organic chemistry research group works on the isolation, structure elucidation, and bioactivity focused semi-synthetic modification of natural products, mainly ecdysteroids, flavonoids and other antioxidants. On the borderline of natural product chemistry and biology, we study the specific bioactivities of antioxidants' metabolites in order to find new leads for drug discovery. A large variety of preparative and analytical chromatographic techniques are utilized; bioactivities are tested through a wide international collaboration network. The head of the research group is: Dr. Attila Hunyadi, members are: four Ph.D. students; Ibolya Hevérné Herke, laboratory technician.

INSTITUTE OF PHARMACEUTICAL ANALYSIS

The aim of the foldamer research group is to create new macromolecules from unnatural building blocks, of which secondary structure can be predicted and programmed. Manipulating protein-protein, and protein-carbohydrate interactions is a challenge yet to be met by pharmaceutical researchers. While original small molecule drugs can not effectively decouple macromolecule interactions in general because of their geometry, the right sized and often used antibodies have a lot of disadvantages. Our research group tries to find the solution in the utilization of artifically self-assembling proteinmimetics. To study these molecules, molecular modelling, peptide synthesis, structural characterization and investigation of biological activity is used.



Proteins are the building blocks of life. The aim of the protein research group is to understand and characterize membrane proteins, which are the most prominent drug targets. One of our research involves multidrug-resistant transporters, which are the cause of antimicrobial resistance. The other one is about the vanilloid receptor, which takes part in the conception of pain. From the in vitro interactions of these transporters with different small molecules, or proteins, we can determine their roles in in vivo biochemical processes.

INSTITUTE OF PHARMACEUTICAL CHEMISTRY

The Institute of Pharmaceutical Chemistry, University of Szeged is an internationally recognized research site with approx. 120 peer reviewed scientific publications and 5 patents in the last 3 years. The institute's main fields of activity are (i) the development of advanced organic synthesis methods, like continuous flow technologies, enzymatic and green chemistry, etc., (ii) the pioneering research

in the synthesis of chiral organic building block with exotic substituents and application thereof in the synthesis and structure characterization of selforganizing artificial polymers (foldamers).

Continuous flow (CF) approaches have recently gained in significance among synthetic techniques, in consequence of the massive number of advantages they offer over conventional batch procedures. A sound deuteration technology was developed, where the deuterated product is gained in an economic and faster way compared to conventional technologies Parallel, CF highly efficient organocatalytic technologies were discovered, where modular peptides were used as catalysts. By the utilization of elementary copper catalysis, a highly robust and efficient CF azide-alkine click chemistry was developed. Most prominently, volutionary peptide synthesis technique was established, of which was patented too. This technology allows the synthesis of peptides with the utilization of only 1.5 equivalents of the amino acids. This fact is unprecedented and especially useful in the synthesis of peptide oligomers containing unnatural and expensive building blocks.

The Institute of Pharmaceutical Chemistry is an internationally known research site for enzymatic chemistry. The main activity is based on enzymatic resolution of β-amino acids and derivatives thereof. Numerous sound publications appeared in recent years, while some procedures were patented too. On being green, solvent free and water based technologies were developed for the synthesis of various heterocycles.

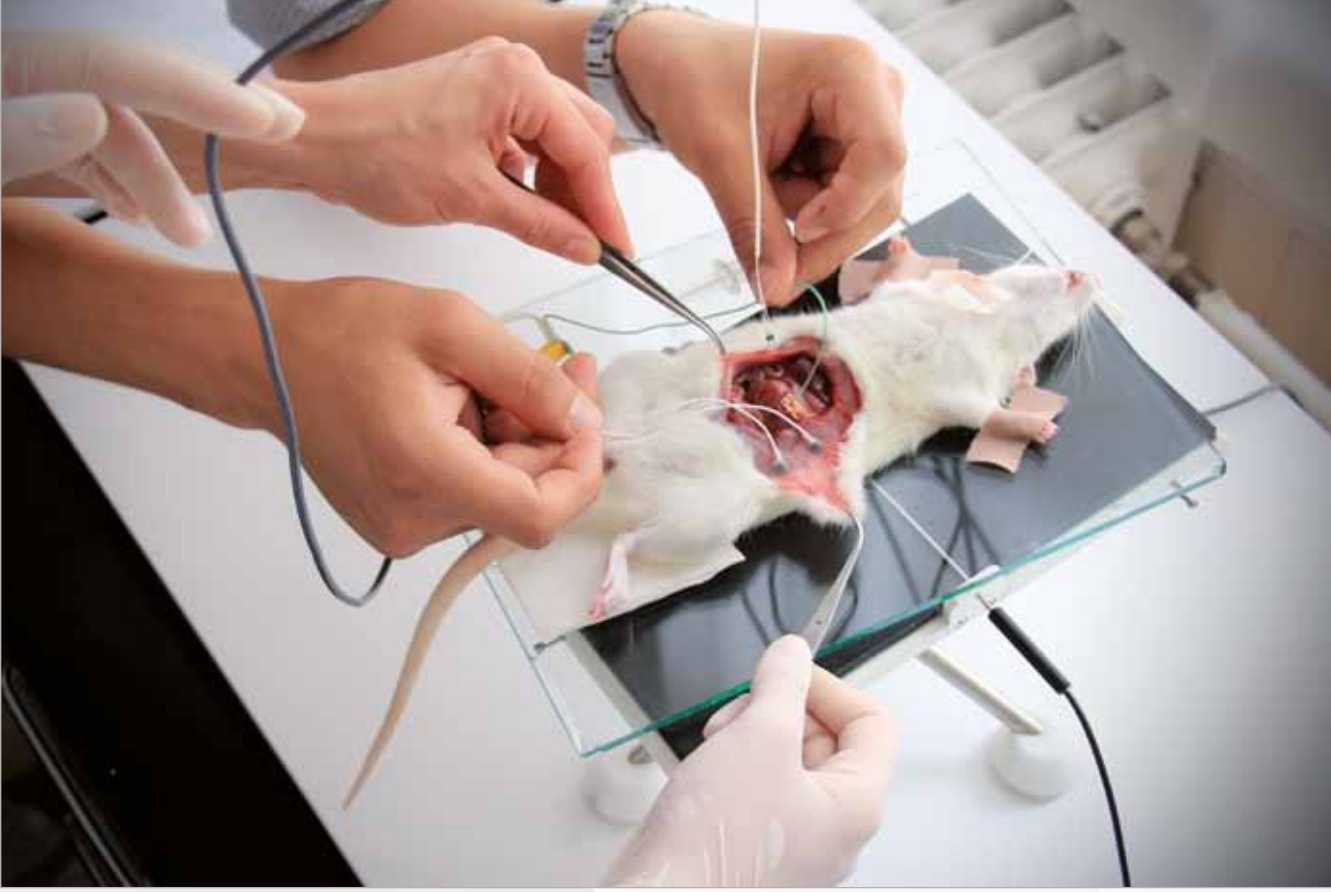
The development of exotically substituted β-amino acid based building blocks is a further mainstream activity of the institute. This fact is underlined by the numerous publication appeared in recent years utilizing a wide range of chemical transformations. Importantly enatiomerically pure substrates are prepared in large scale too. These building blocks are incorporated into artificial self-organizing systems, of which show interesting biomedical and nanochemical properties.

DEPARTMENT OF PHARMACODYNAMICS AND BIOPHARMACY

Department of Pharmacodynamics and Biopharmacy (head: Róbert Gáspár, PharmD, PhD, associate professor) has two main research topics: the reproductive pharmacology and the antiproliferative studies.

In reproductive pharmacology the research is focusing on pregnant myometrium, searching for new targets and compounds to inhibit premature birth. The extensive smooth muscle project involves the in vitro and in vivo contractility studies, electromyographic studies and molecular pharmacological studies (RT-PCR, Western blot). Additionally a wide range of method for in vivo animal studies are also available, e.g. for inflammatory and hormonal studies. The animal experiments are supported by an Animal Facility that is suitable for short-, medium-, or long-term experiments, including toxicological, aging or generation studies. In the Bioanalytical Unit pharmacokinetic studies including method development, assay validation and specimen analysis are also available.

The cell culture laboratory (Principal Investigator: István Zupkó, PharmD, PhD, associate professor) engaged in the investigation of the antiproliferative properties of plant extracts, natural compounds and their synthetic analogs. The laboratory equipment includes viability assays, fluorescent microscopy, endpoint and kinetic microplate-based assays, determination of crucial cell cycle regulators and factors involved in apoptotic procedures. Additionally, flow cytometry is utilized in order to obtain data concerning the mechanisms of action of tested compounds (cell cycle analysis and antibody-based assays). These assays are performed primarily on gynaecological cancer cell lines, including a breast cancer panel involving cells differing in biochemical background and a cervical cancer panel with cells of various pathological parametres.



DEPARTMENT OF DRUG REGULATORY AFFAIRS

The research profile of the Institute of Drug Regulatory Affairs is mainly based on the innovative applying of the quality management methods. Our research activities and strategy can be characterized by the quality assurance and quality improvement methods. These are applied in several pharmaceutical fields from the early development until the daily pharmacy practice (e.g. technological and dosage form development, pharmaceutical registration, patient adherence and satisfaction studies in pharmacy, quality improvement of the pharmacy services etc.). Beside this we started to make "regulatory science" based theoretical developments (investigations are focused especially on the framework of the authorization and pharmaceutical technology) as well.

DEPARTMENT OF CLINICAL PHARMACY

Pharmacoepidemiology is the main research area of the Department of Clinical Pharmacy. In Hungary the department is considered an important research group in this field, as such research is performed only at a very few organizations. The department carries out research on various areas of the Hungarian drug utilization, and participates in several international research projects. The research focuses on different aspects of rational drug use, studying the qualitative and quantitative indicators of drug use (drug utilization studies, adherence, polypharmacy, quality of life, therapeutic drug monitoring).

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UNIVERSITY OF SZEGED

FACULTY OF DENTISTRY

Prof. Dr. János MINAROVITS,
M.D., D.Sc.

In addition to providing dental treatment for patients and teaching, there are also diverse research activities going on at the Faculty of Dentistry with the participation of dentists, physicians, physicists as well as biologists. Studies on biointegration and biocompatibility of dental implants were initiated by our co-workers more than 15 years ago, i.e. even before the establishment of an autonomous Faculty of Dentistry at the University of Szeged, and this is an important research topic, still. In 2012, in order to strengthen research activities, a new department was established. The experienced researchers who joined to the Department of Oral Biology and Experimental Dental Research opened up new research areas in addition to the well established ones. Because the research infrastructure of the Faculty needs a significant improvement, scientific ties with other faculties and institutes of the university are vital for high quality research. There are especially fruitful collaborations with coworkers of the Faculty of Medicine, including the Department of Dermatology and Allergology, Department of Rhino-Laryngology and Head- Neck Surgery, Institute of Clinical Microbiology, Department of Medical Genetics, and with coworkers of the Faculty of Science and Informatics, including the Department of Biotechnology and Department of Optics and Quantum Electronics. There are close ties with the Institute of Biochemistry, BRC, HAS, Szeged, too.

MOTTO:

RESEARCH & EDUCATION TODAY, BETTER HEALTH TOMORROW

MOLECULAR CHARACTERIZATION OF ORAL CARCINOMA

Janos MINAROVITS M.D., D.Sc. *(Department of Oral Biology and Experimental Dental Research)*

The 5 year survival of patients with head and neck cancer (HNCC) including oral carcinoma is 50% in spite of recent improvements in therapy. For this reason it is a highly important to identify potential biomarkers that may permit the early diagnosis of HNCC as well as the monitoring of treatment. Using saliva and HNCC biopsy samples, the group aims at the detection of oncoviruses and other microbes as well as various biomolecules that are potentially involved in carcinogenesis. This is a collaborative research with the participation of the Department of Oral Surgery, Department of Rhino- Laryngology and Head- Neck Surgery, Institute of Clinical Microbiology (Szeged), and the National Center for Epidemiology (Budapest).

METAGENOMIC ANALYSIS OF THE ORAL MICROBIOME

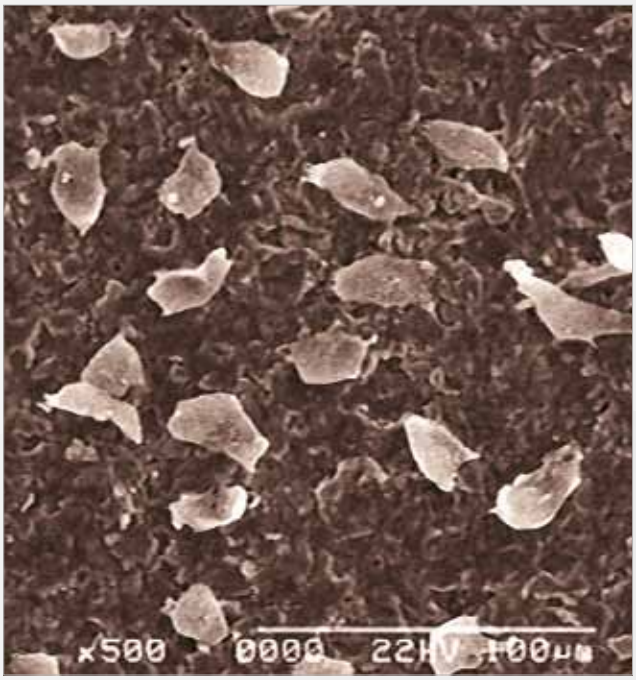
Kornél KOVÁCS, PhD, DSc *.(Department of Oral Biology and Experimental Dental Research)*

The group focuses on complex microbial communities and on understanding the interactions among the members of such communities. The experimental system studied by the lab for a long time is the microbial community carrying out the complex process of anaerobic decomposition of biomass leading to biogas formation. Based on similar operational principles but obviously involving distinct microbial partners are the oral microbial communities or the ones involved in type-1 diabetes mellitus in a rat model. In the experimental approaches both classical microbiological and modern molecular techniques, e.g. qPCR, next generation DNA and RNA sequencing, metagenomics, transcriptomics, FISH, and T-RFLP are employed.

IN VITRO TESTING OF DENTAL MATERIALS

Kinga TURZÓ PhD
Krisztina UNGVÁRI, PhD
(Department of Oral Biology and Experimental Dental Research)

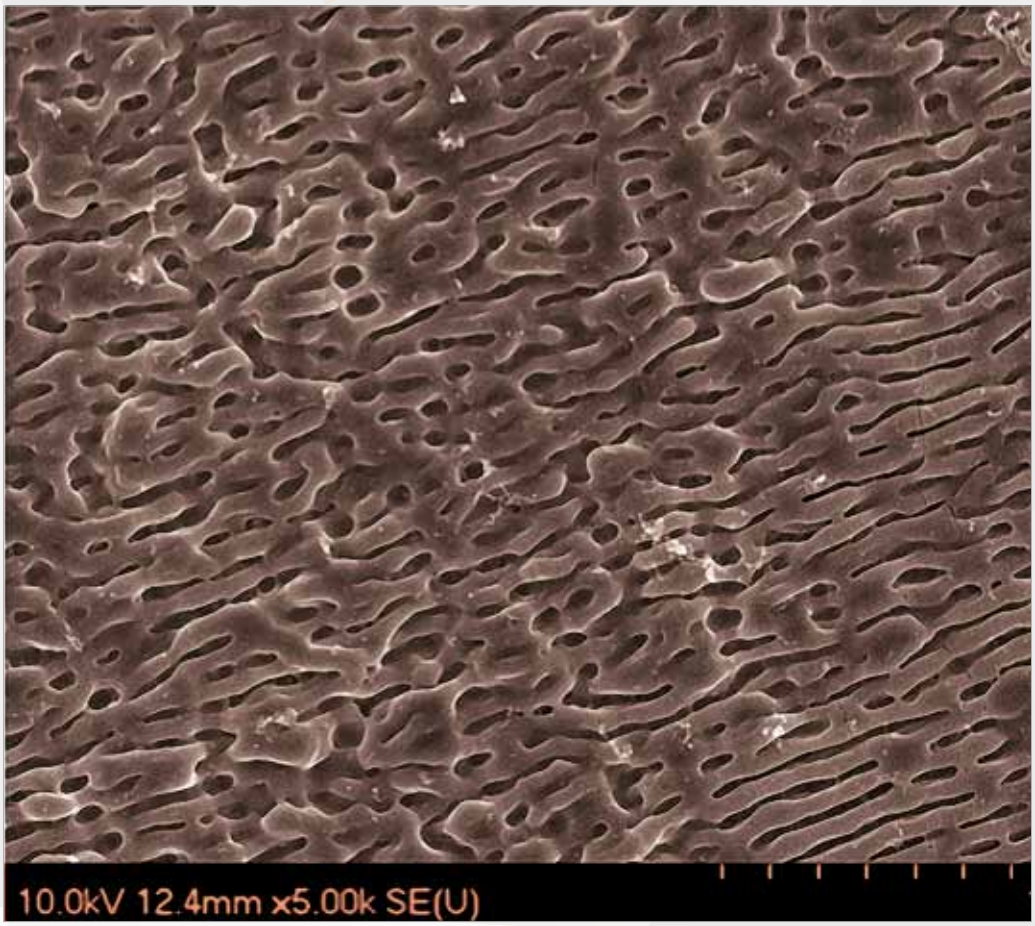
The group performs in vitro studies on different surface-modified materials used in dentistry and medicine. Both human cells separated from oral mucosa and MG63 cells (an immortalized cell line) are used to assess how cell adhesion and proliferation is affected by various surface modifications of dental materials. Surface attachment of various bacterial strains is also tested, in collaboration with the Institute of Clinical Microbiology,



MODIFICATION OF TITANIUM SURFACE USING NANOSECOND LASERS

Dr. Zsolt TÓTH PhD *(Department of Oral Biology and Experimental Dental Research)*

Sterile surface polishing was achieved using nanosecond pulse length ArF excimer laser ablation. Polishing of the neck part of the implant is important, because the smooth surface may inhibit the adhesion of pathogens. Atomic force microscope, scanning electron microscopy X-ray photoelectron microscopy and X-ray diffraction analysis showed that laser ablation resulted in a smooth surface, removed surface contamination and allowed the formation of a titanium dioxide layer with a proper crystalline structure.Titanium surfces treated with nanosecond lasers were studied in vitro using MG63 human osteoblast-like cells. Laser treatment of the surface did not hinder cell growth. Effective surface roughening was achieved by picosecond KrF excimer ablation. Establishment of optimal surface roughness may facilitate the adhesion of osteoblats during osseointegration.



EXOSOMAL INFORMATION TRANSFER AND THE USE OF BIODEGRADABLE POLYMERS IN TISSUE REPLACEMENT

Krisztina BUZÁS PhD *(Department of Oral Biology and Experimental Dental Research)*

The group deals with the communication between tumor cells and non-tumor cells located to the tumor matrix Their aim is to reveal how the information content of tumor cell-derived exosomes affects the phenotype of non-tumor cells and the process of tumor progression. In collaboration with Szabolcs Beke, PhD (ITT, Genova, Italy) they study the use of biodegradable polymers for tissue replacement. Scaffolds produced by the Italian partner are colonized by stem cells and implanted into mice to study the immune response evoked. This work is performed in the BRC, HAS, Szeged.

MAXILLOFACIAL PROSTHETIC REHABILITATION

Katalin NAGY, PhD *(Department of Oral Surgery)*

Progress in treatment of oral cancer has made it possible to reduce the post-treatment mortality and the survival rate was increased. Maxillofacial rehabilitation is the last step in the treatment of head and neck cancer that aims to restore the pre-illness function. Quality of life in patients treated for head and neck cancer is an important outcome parameter in the post-treatment follow-up. The aim of the research is to examine how does the quality of life of head and neck cancer patients decay after treatment (operation, radiotherapy, chemotherapy), and how can it be improved with maxillofacial prosthetic rehabilitation. Reserch activity extends to a variety of areas affecting the quality of life, including pain, function, esthetics, bad breath and oral microbiology.

ORAL AND SYSTEMIC DISEASES RESEARCH GROUP

Gábor BRAUNITZER, PhD *(Department of Oral Surgery)*
Márk ANTAL, DDM, PhD

The main profile of the group is the exploration of links between oral (e.g. periodontal disease) and systemic diseases (e.g. psoriasis, rheumatoid arthritis), with special attention to the influence of smoking on such interactions. Their first significant publication on this topic appeared in PLOS One in March 2014. They assume that smoking, acting as a permissive factor, amplifies the destructive aspects of inflammation, thereby deteriorating the patients' condition and increasing the chance that further inflammatory diseases develop. The group is in an active cooperation with several clinics of the University of Szeged, and foreign partners include the Faculty of Dentistry at the University of Hong Kong and NYU College of Nursing. The group also supervises PhD students.

HIGHLY EFFICIENT CLEANING OF TITANIUM SURFACES

István PELSŐCZI KOVÁCS, DDM, PhD *(Department of Prosthodontics)*

The surface properties of titanium implants play an important role in successful biointegration. Initially the group studied the chemical composition, purity, roughness and surface energy of unmod-

ified and modified titanium surfaces and tested their interactions with cells in vitro. Recently their attention turned to efficient cleaning of titanium surfaces. They combined methods that proved to be successful in other areas like microelectronics where there is a demand for ultra-clean processing. In preliminary experiments they could produce significantly cleaner surfaces compared to the standard procedure. These results may be utilized by Hungarian enterprises.

THE EFFECT OF CHEMICALS INTERACTING WITH TITANIUM IMPLANTS ON BIOFILM FORMATION

Anette STÁJER, DDM, PhD *(Department of Prosthodontics)*

Reducing agents present in prophylactic gels may damage the surface of titanium implants, a process that may facilitate bacterial colonization. The group aims at the analysis of surface modifications caused by such agents. They also wish to study biofilm development on surfaces treated with drugs used for the treatment of periimplantitis.

ORTHODONTICS AND PEDIATRIC DENTISTRY

Emil SEGATTO, DDM, PhD *(Department of Orthodontics and Pediatric Dentistry)*

Research areas: in addition to applied research related to orthodontics they also deal with facial esthetics analysis and its applications to orthodontics, orthodontic imaging methods and dental care for special needs patients in pediatric dentistry.

INVESTIGATION OF RARE MONOGENIC ECTODERMAL DYSPLASIAS CHARACTERIZED BY PERIODONTAL DISEASES AND NEW INNOVATIONS IN NON-SURGICAL PERIODONTAL THERAPY

Péter VÁLYI, DDM, PhD *(Department of Periodontology)*

Ectodermal dysplasias (EDs) are classified as congenital disorders characterized by abnormal development in two or more ectodermal structures (e.g. early-onset periodontitis) without other systemic findings. The group aims at the identification of genotype-phenotype correlations and wishes to elucidate the mechanism of the different phenotypic variations of EDs with periodontal diseases. A further goal is the development of causative therapies. Cause-related, non-surgical treatment forms the base of complex periodontal treatment; it aims at the elimination of periodontopathogenic microorganisms and the restoration of the ecology of periodontal environment. The group is involved in the development of new formulas of antibacterial agents and in the evaluation of applications of new devices such as medical laser systems.

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UNIVERSITY OF SZEGED

FACULTY OF ENGINEERING

Faculty of Engineering is a technical faculty with 50 years of educational and R&D experience, in a perfect balance of theoretic and practice based on extensive industrial relations. The Faculty has changed a lot during the transition from a College of Food Engineering to a Faculty of Engineering, but its fundamental philosophy has remained unchanged. Citing the wisdom of Albert Szent-Györgyi, a Nobel laureate scientist and earlier rector of the University of Szeged: The pillars of a school are not its walls but its spirituality.

MOTTO:

CONSTANTLY RENEWABLE KNOWLEDGE BASED ON THE VALUES OF THE PAST


VALVE CLOSED PERIOD
VIBRATION

WASTE RECYCLING AND RENEWABLE ENERGIES RESEARCH GROUP

An important research area of our research group is developing procedures for the extraction of bioactive compounds from food-industry waste, and investigating the possibilities of agricultural and food industry waste's bioenergetic utilization. One of the most important and practically significant result of our research is the development of a microwave method for enhancing the food industry sewage's biodegradability and to increase the biogas production. The microwave research includes increasing enzymatic process intensity in food industry and biofuel production systems.

MEMBRANE AND ENVIRONMENTAL ENGINEERING RESEARCH GROUP

Main research area is the examination and application of advanced oxidation processes combined with membrane technology. The research group investigates whether and how the pretreatments based on advanced oxidation processes (eg. Ozone, hydrogen peroxide, UV light, Fenton reaction, or their combinations) affect the membrane filtration, the membrane clogging and the flux values. One direction of the research is the filterability examination of waters with high organic matter content, primarily hydrocarbon-containing water filtration; these results could be useful in the pre-treatment of deep waters and thermal waters prior to their use.

FOOD ENGINEERING RESEARCH TEAM

We continuously manage the classical Research-Development work in our analytical and pilot technological laboratories as the product development, process and technology development, investigation of the processes on the properties of products, chemical, microbiological and other tests.

THE MAINSTREAM OF OUR RESEARCH AREA:

- The investigation and development of technologies, processes to decrease the risk of environment, including the revision and improvement of the different classical heat-treating processes and the new, "non-thermal" processes (as the membrane technique and cold plasma), for the specific separation of components, lower energy supply, improvement of food safety and economical aspects.
- Separation, extraction and concentration of bioactive components of raw materials and foodstuffs. Investigation of the applicability and the effects of bioactive components during the food "production".
- Decrease of pollutants in foods – improvement of food safety, mainly the investigation of technological possibilities to decrease the mycotoxin content of cereals. Explore of new mycotoxins in different cereals, development of the detection method of mycotoxins.

LOGISTICS RESEARCH GROUP

Our goal to examine and develop public transport infrastructure in Szeged. Technology innovation of electricity powered vehicles. Other part of activity of this team is logistics in agro-business.

BIOMECHANICAL RESEARCH GROUP

At present it is a general aim in biomechanics to create a better mechanical model of human knee joint which can approach the natural motion and on its basis to make new prostheses. The cause of complexity is partly the elaborateness of elements, partly the typical rheological properties of the components (bones, cartilages and other soft tissues). The aim of the investigation is to determine the kinematical parameters of tibia compared to the fixed femur during flexion and extension.

PNEUMATIC ARTIFICIAL MUSCLES (PAM) RESEARCH GROUP

With pneumatic artificial muscles we can easily and economically do the work done by human or animal muscles. PAM applications are mainly medical one,but there are increasing robotic applications as well as light industrial applications.

www.mgk.u-szeged.hu

UNIVERSITY OF SZEGED

FACULTY OF AGRICULTURE

THE FACULTY OF AGRICULTURE OF THE UNIVERSITY OF SZEGED - BEING THE PART OF THE LOCAL PROFESSIONAL AGRICULTURAL TRAINING OF MORE THAN 110 YEARS - REPRESENTS AGRICULTURAL HIGHER EDUCATION IN HÓDMEZŐVÁSÁRHELY FOR MORE THAN 50 YEARS. THE FACULTY IS THE PART OF THE UNIVERSITY OF SZEGED SINCE 1ST OF JANUARY 2000.

The educational and research work is organized in three Institutes:

INSTITUTE OF ANIMAL SCIENCES AND WILDLIFE MANAGEMENT
INSTITUTE OF ECONOMICS AND RURAL DEVELOPMENT
INSTITUTE OF PLANT SCIENCES AND ENVIRONMENTAL PROTECTION

The Faculty offers undergraduate (BSc) programs in Agricultural engineering and Wildlife management engineering, the former one also in English. Besides undergraduate programs, studies can be performed in engineer assistant specialist and postgraduate specialist training courses, too. Specialized courses for professionals are organized by the Department of Further Training and Regional Extension Center. Research groups being active at the Faculty are described below.

MOTTO:

SCIENCE, PRACTICE, TRADITION FOR AGRONOMISTS OF FUTURE

AGRICULTURAL ECONOMICS RESEARCH GROUP

Károly BODNÁR *PhD, habil.*
József HORVÁTH *PhD, habil.*
László MAKRA *PhD, habil.*
Levente KOMAREK *PhD, PhD*
Margit HÓDINÉ SZÉL
Dr. Péter JANI

The major research fields of the group are the following:

The marketing of local products, consumer behaviour related to specific agricultural products, the investigation of meat-rabbit production economy as well as the organizational background and human resource of agricultural logistics.

Complex economic analysis of agricultural by-products and waste utilization. To meet the growing needs of the world population (food, industrial products, raw materials, energy, etc.) there are growing requirements concerning the different sectors of the economy. Agriculture should move towards diverse production patterns that reflect the multi-purpose strength, and allow the closed nutrient cycling on the one hand and at the same time the utilisation of the by-products and waste to produce energy. Changes in the environmental and economic conditions could increase the vulnerability of agricultural systems, and decrease adaptability. That is the reason why the complex economic analysis of the structure of production and economic return on investment planning, as well as that of logistical and organizational issues is necessary.

In recent years, research was focused on the regional specialization and sectoral concentration of Hungarian agriculture and industry after the regime change. The main goal was to conduct a detailed analysis whether there was regional specialisation in Hungarian primary and secondary sectors, as well as if the industrial concentration was strengthening or weakening, and in which areas, industries, sectors, what were the causes and what effect it might have on the future development of our agriculture and industry, and also on the rational development of agricultural and industrial structure.

Due to the rapid spread of information technology it is essential that computer-assisted instruction receive an increasing role in the teaching of science subjects as well. Illustration is very important in education. When examining the possibilities of applying mathematical and statistical analysis programs the objective is to develop problem-solving skills, formulating and solving practical issues on a computer, evaluating and analysing the results we get.

The most important source areas of ragweed pollen transport for Szeged area, Southern Hungary, were delimited. By applying a new statistical procedure, medium range pollen transport including local pollen release from long-range pollen transport were separated. Time-varying linear regression and time-varying nonparametric regression models were developed to predict the daily pollen concentration for Szeged in Hungary. Procedures considered as new in the professional literature, were applied for studying respiratory diseases based on meteorological variables as well as chemical and biological air pollutants.

ANIMAL HUSBANDRY RESEARCH GROUP

Edit MIKÓ *PhD*
Myrtill GRÁFF *PhD*
Ákos BENK *PhD*
Zoltán DEIM *PhD*

Evaluation of the production of dairy and beef cattle. Influence of milk production level during lactation on reproduction parameters of Holstein Friesian cattle. Analysis of breeding strategies of

dairy farms. Studies on the production of dairy cattle and on the somatic cell count of milk. The effect of the production level of Holstein Friesian cattle on the milk composition as well as on the condition. Studies on the parameters influencing the growth of beef calves.

Animal welfare research field: Animal welfare questions of livestock husbandry.

Studies on the production performance of Saanen goats: Connection between condition score, milk production and prolificacy in Saanen goat populations.

Variety maintenance and gene conservation of Hungarian speckled hen: The research aims to describe the variability or stability of quality parameters of the Hungarian speckled hen and the speckled Transylvanian naked neck hen.

PLANT PRODUCTION AND HORTICULTURE RESEARCH GROUP

Tamás MONOSTORI *PhD*
Péter JAKAB *PhD*
Ferenc LANTOS *PhD*
Lajos TANÁCS *CSc, habil.*
László SALLAI *PhD*
Tímea SÜLI-ZAKAR *PhD*

Our research in arable crops, primarily in cereals, aims to examine the agrotechnical reactions of the plants and plant populations. We focus on the environmentally friendly, sustainable solutions of plant nutrition, both in traditional and in organic farming. We evaluate the influence of nutrition on the yield, yield components and quality parameters of plants.

A powdery mildew resistant genotype of cherry-shaped pepper growing wild in Mexico which was selected in Szentes, if applied as rootstock, results in the hindering of powdery mildew development in the scion (Ferenc Lantos personal communication). We study the inhibition of powdery mildew development in comparison experiments with selected lines from Szentes and other peppers of the similar type.

In our laboratory there is a continuous work on the adaptation and development of in vitro micropropagation methods of horticultural plants. We successfully produced rooted plants by the induction of axillary buds and generated a somatic plant-cell-plant system in cactus species previously not involved in in vitro cultures. Besides the efficient micropropagation of several ornamental species, currently we are working on the adaptation of techniques in sweet potato and strawberry.

To fulfill the increasing consumers' needs for sweet potato [*Ipomoea batatas* (L.) Lam.] we make variety- and site-specific improvements in the current cultivation technology, as well as we study the possibilities of the utilization of by-products (shoots, substandard tubers).

In the intensive, especially in the soilless forcing technology of sweet pepper, blossom end rot caused by calcium deficiency is a significant problem. The subject of the studies performed in the cooperation with domestic research institutes is to evaluate the correlation between calcium as well as calcium-dependent antioxidants and enzymes.

In the research program on the role of jasmonates in the development of wheat, the effects of the endogenous allene oxide synthase level modified by gene-technology on the development and endogenous jasmonate level of wheat, as well as the possible changes in the biotic and abiotic stress responses of the transgenic plants are studied.

ANIMAL NUTRITION RESEARCH GROUP

Judit PÉTER SZŰCS *CSc, habil.*
Ágnes SÜLI

Forage conservation: The evaluation of various conservation methods and preservative products, forage analysis by chemistry techniques.

Functional food production: The studies aim to develop a milk of more beneficial fatty acid composition from the human health point of view. We examine the effects of feeding with cold pressed linseed, rapeseed and sunflower seed on the fat content and on the fatty acid composition of milk fat in the milk of Holstein Friesian cattle.

GAME BIOLOGY, WILDLIFE MANAGEMENT AND NATURE PROTECTION RESEARCH GROUP

István MAJZINGER *PhD*
Erika SKOBRÁK BODNÁR *PhD*
Orsolya KISS

Studies on the reproduction performance of roe deer: The effect of the quality and type of habitat on the most important biological parameters of the roe deer population. The utilization of results and correlations in the population management praxis.

Monitoring of brown hare populations: Studies on the dynamics and certain reproduction parameters of the brown hare population.

Development of computational population management models: brown hare, roe deer.

Studies on the chemical composition of game (wild boar) meat: Among the factors influencing the chemical composition of meat, the effects of various feeds are evaluated.

Game preserves: Examination of those body size parameters of wild boars which can be correlated with the efficiency indicators of game managers. The utilization of results in the selection of breeding animals.

Habitat preferences of European Roller: We investigate various aspects of habitat selection of European Roller in correlation, among others, with the quantity and temporal changes of feed supply, as well as the hatching results of the species. The evaluation of the occurrence of European Roller at a higher scale by geo-informatics tools is also part of the research.

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UNIVERSITY OF SZEGED

FACULTY OF ECONOMICS & BUSINESS ADMINISTRATION

ECONOMIC TRAINING IN SZEGED IS POPULAR FOR VARIOUS REASONS; HOWEVER, THE BASIS OF HIGH-QUALITY EDUCATION IS THE WORK OF PROFESSIONALLY AND METHODOLOGICALLY WELL-TRAINED INSTRUCTORS WHO ARE ABLE TO SUPPORT THE TALENTED. THE PAST ONE AND A HALF DECADES BROUGHT NOT ONLY FAME TO THE EDUCATION OF THE FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION OF THE UNIVERSITY OF SZEGED (SZTE GTK) BUT ALSO GAVE AN OPPORTUNITY FOR THE RESEARCH GROUPS AND RESEARCH SCHOOLS TO GROW STRONG.

The research projects of the students at the Faculty are regularly acknowledged in both the closer and wider professional circles and, often, in the media as well. However, there is a more important aspect too: the research findings can effectively assist and help the present and prospective business and institutional partners in the fields of regional competitiveness, economic development, finances, international economy, marketing and management, as well as statistics. The regular feedbacks on the research projects of the Faculty provide indications on the economic development of the region. We are ready to offer our services in research projects in the following topics and in further tasks, such as carrying out economic impact studies, surveys, public opinion polls and regional analyses. The current issues of regional science (e.g. the theoretical questions of regional competition and competitiveness, the practice of cluster-based regional economic development in order to improve competitiveness, innovative cooperation with local – knowledge-based – business development, the methodology of identifying spatial concentration and agglomeration) is a focus of the Faculty's researchers. Furthermore, the members of the academic staff of the Faculty study with the capability approach how to establish local economic development and regional innovation policy. Among the projects of the research centre there is one research that studies the possible role of the capability approach in the local decision making processes. In the area of finances, the academic staff of the Faculty study extreme events and divergences in the capital markets, the role of risk capital in corporate finances, the risks of local government finances, international aid programmes; they conduct researches in accounting sciences, European integration and the financial literacy of secondary school students. Among the disciplines of marketing and management, the areas of study at the Faculty of Economics and Business Administration include knowledge and information management, relations marketing, the performance assessment of public utility services, market research, lifestyle analyses, researches in organizational culture, and quantitative and qualitative researches. In the area of statistics, the main areas of research are statistical literacy, the methodology of statistics education, multivariate data analysis, demography of the Hungarian minority outside Hungary, society statistics and economic statistics.

PRIORITY RESEARCHES: 2014–2016

INTERPLAYS BETWEEN THE ECONOMY OF THE SOUTHERN GREAT PLAIN OF HUNGARY AND THE ELI

The members of the academic staff of the Faculty of Economics and Business Administration have undertaken to use scientific methods to find answers to the questions raised by the relationship between the economic future of the Southern Great Plain and the Extreme Light Infrastrue (ELI), the large investment project of the EU.

- How do the support of innovation and the encouragement of research and development or the lack of these processes have an impact on the success of the ELI?
- What opportunities can the Science Park designed to be established around the ELI offer for the local economy?
- Will the human resource base of the region be able to make an investment project of such a large scope a success?
- What basis does the entrepreneurial culture of the Southern Great Plain have for the developments?
- How much is the financial culture of the knowledge-intense businesses in the region ready to cater for an international investment?
- Do the businesses in the region have the necessary cooperation skills to maximally activate the economic effects of the ELI?

RESEARCH ON THE FINANCIAL CULTURE OF THE YOUNG AND THE BUSINESSES

A research has been studying the financial culture of the young since 2011, on an annual basis, with one of the largest sampling in Europe. Besides financial attitude, the knowledge of six other areas is also targeted in the survey (banking services; savings and investments; loans; pension and insurance; the world of work; and the knowledge on general economics: inflation, taxation and country risk). The financial culture of the businesses is also studied with large sampling. The aim of this research is to find the characteristic features of the financial culture of knowledge intense businesses as the target group of innovation focussed economic development compared to the financial culture of non-knowledge intense businesses. For further information on research projects of SZTE GTK, please click onwww.eco.u-szeged.hu/kutatas.

KNOWLEDGE TRANSFER
EMERGING ZONE

IMPRESSUM: *Our brochure is supported by the* **European Union and co-funded by the European Social Fund** • Call identifier: **TÁMOP-4.2.1.C-14/1/KONV-2015-0013** *„Economic and social positioning of the University of Szeged based on the quadruplehelix model, developing the practices of knowledge transfer within the Hódmezővásárhely – Szeged emerging zone"* • Produced by **University of Szeged Directorate for R&D and Innovation** • Published by **Gábor Szabó, Rector** • Printed by **Innovariant Nyomdaipari Kft.** H-6750 Algyő, Ipartelep 4.; Hungary, in 2015

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SZÉCHENYI 2020

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